SMRI '93
Abstract Form

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You must use the format detailed on page 2 and designate the beginning of each:
■ Purpose ■ Methods ■ Results ■ Conclusion

Your abstract must be double spaced and **cannot exceed 250 words**. Avoid excessive use of acronyms and abbreviations. If the four segments exceed 250 words, only your purpose and conclusion will be printed. Do not mechanically reduce your application to fit in the space provided. No graphs, halftones or tables can be included within abstract.

Title of Abstract:

Fourier Analysis of Functional EPI Time-Course Series

PURPOSE: A robust new method of creating brain activity images by Fourier Analysis of echo-planar imaging (EPI) time-course series is presented.

METHOD: We use, on a 1.5-T Signa with a three-axis local gradient coil of original design, blood oxygenation-sensitive gradient-echo (1,2) (TE= 40ms, TR < 3 sec) or spin-echo (3) (TE= 100ms, TR < 3 sec) single-shot EPI to obtain single or multi-slice (thickness = 4 to 15mm, FOV = 24cm, resolution = 64 x 64) time-course series of up to 128 sequential images. During the time course, neuronal activity is modulated in a square wave manner by specific tasks. The hemodynamic response behaves as a low pass filter of the square wave, causing the MR signal to approach a sinusoid at the activation frequency. The Fourier Transform is then applied to the time response vector of each pixel, creating a series of spectral density images.

RESULTS: After the Fourier Transform is applied, a resonance peak is apparent in the the activated brain region. The image residing at the activation frequency peak in the transformed data set clearly delineates the periodically activated brain tissue.

CONCLUSION: Advantages of this method over simple subtraction of baseline images from activation images include: *1.* No baseline or activation period is arbitrarily chosen. *2.* Many tasks, oscillated at different frequencies, can be multiplexed into one time-course series. Different activated brain regions therefore appear at different resonant peaks in the frequency image set. *3.* Higher harmonics contain information about the details of the time course in specific brain regions.

REFERENCES:

1. Kwong, K.K. , Belliveau, J.W., Chesler, D.A., Goldberg, I.A., Weisskoff, R.M., et al. PNAS 89: 5675 - 5679, 1992.

2. Bandettini, P.A. , Wong, E.C., Hinks, R.S. ,Tikofsky, R.M., and Hyde, J.S., Magn. Reson. Med. 25: 390-397, 1992.

3. Bandettini, P.A. , Wong, E.C., Hinks, R.S., Estkowski, L.S., and Hyde, J.S. , SMRM 11'th Annual Meeting, Works In Progress: 719, 1992.